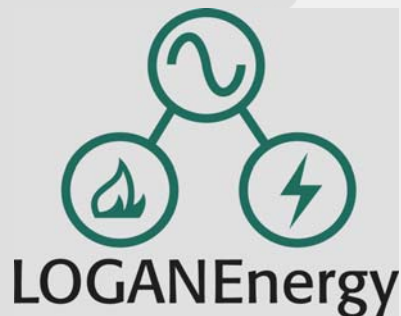


W91321-04-C-0023



Midterm Report  
March ARB PEM Demonstration Project  
Riverside, California

Proton Exchange Membrane (PEM) Fuel Cell Demonstration  
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers  
Engineer Research and Development Center  
Construction Engineering Research Laboratory  
Broad Agency Announcement **CERL-BAA-FY03**

**Headquarters:**

1080 Holcomb Bridge Rd  
Suite 100-175  
Roswell, GA 30076  
Ph (770) 650-6388

March Air Reserve Base Kisling Hall  
Building #400  
Riverside, California

August 4, 2005

**California:**

74837 Diamond Bar Rd  
29 Palms, CA 92277  
Ph (760) 367-5005

## **Executive Summary**

Under terms of its FY'03 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy has installed and begun operation of a Plug Power GenSys 5kWe Combined Heat and Power fuel cell power plant at March Air Reserve Base. The unit has been sited at a very visible location in front of Kisling Hall, Building 400, an airman's dormitory.

The fuel cell has been electrically configured to provide both grid parallel and grid independent service while also being thermally integrated with the facility's hot water system. Local electrical and mechanical contractors were hired to provide services as needed to support the installation tasks.

It is anticipated that the project will add **\$36.00** in annual energy costs to March ARB during the period of performance. The March ARB POC for this project is Jeff Fong whose coordinates are:  
Email: [jeff.fong@march.af.mil](mailto:jeff.fong@march.af.mil) and Phone: 909-655-2115

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## **Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities**

### **1.0 Descriptive Title**

LOGANEnergy Corp. Small Scale PEM 2004 Demonstration Project at March ARB in Riverside, CA

### **2.0 Name, Address and Related Company Information**

LOGANEnergy Corporation  
1080 Holcomb Bridge Road  
BLDG 100- 175  
Roswell, GA 30076  
(770) 650- 6388

DUNS 01-562-6211  
CAGE Code 09QC3  
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 PAFC and PEM fuel cell projects at 21 locations in 12 states, and has agreements to install 22 new projects in the US and the UK over the next 18 months.

### **3.0 Production Capability of the Manufacturer**

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCore 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Scott Wilshire is the Plug Power point of contact for this project. His phone number is 518.782.7700 ex1338, and his email address is [scott\\_wilshire@plugpower.com](mailto:scott_wilshire@plugpower.com).

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	<a href="mailto:samlogan@loganenergy.com">samlogan@loganenergy.com</a>	<a href="mailto:kspitznagel@loganenergy.com">kspitznagel@loganenergy.com</a>

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	<a href="mailto:samlogan@loganenergy.com">samlogan@loganenergy.com</a>	<a href="mailto:kspitznagel@loganenergy.com">kspitznagel@loganenergy.com</a>

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company  
Ms. Stephanie Chapman  
Merck & Company  
Bldg 53 Northside  
Linden Ave. Gate  
Linden, NJ 07036  
(732) 594-1686

In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability. LOGAN performs the quarterly and annual service prescribed by the UTC, and performs other maintenance as required. The periods of unavailability are chiefly due to persistent inverter problems that seem to be endemic to the Toshiba power conditioning balance of the system. Field modifications and operating adjustments have largely cured the problem. Quarterly service events take 10 hours to complete with the unit under load, and the annual event takes approximately 35 hours with the unit shut down.

b) Contract: Plug Power Service and Maintenance Agreement to support one 5kWe GenSys 5C and one 5kWe GenSys 5P PEM power plant at NAS Patuxant River, MD.

Plug Power  
Mr. Scott Wilshire.  
968 Albany Shaker Rd.  
Latham, NY 12110  
(518) 782-7700 ex 1338

LOGAN performed the start-up of both units after Southern Maryland Electric Cooperative completed most of the installation work. The units are located at residential sites at Patuxant

River Naval Air Station, MD and operate in standard grid connected/grid independent configurations. Both operate at 4.5kWe and have maintained 98% availability. The units, S/Ns 241 and 242 are two of the very latest GenSys models to reach the field. S/N 242 is Plug Power's first LPG fueled system to go into the field. Both have set new performance standards, and raised expectations for near term commercial viability for this product. Operations to date are indicative of the success of the various test and evaluation programs that have been conducted over the past two years.

- c) Contract: A Partners LLC; Commercial PC25 Fuel Cell Project Design, Installation and 5-year service and maintenance agreement.

Mr. Ron Allison  
A Partners LLC  
1171 Fulton Mall  
Fresno, CA 93721  
(559) 233-3262

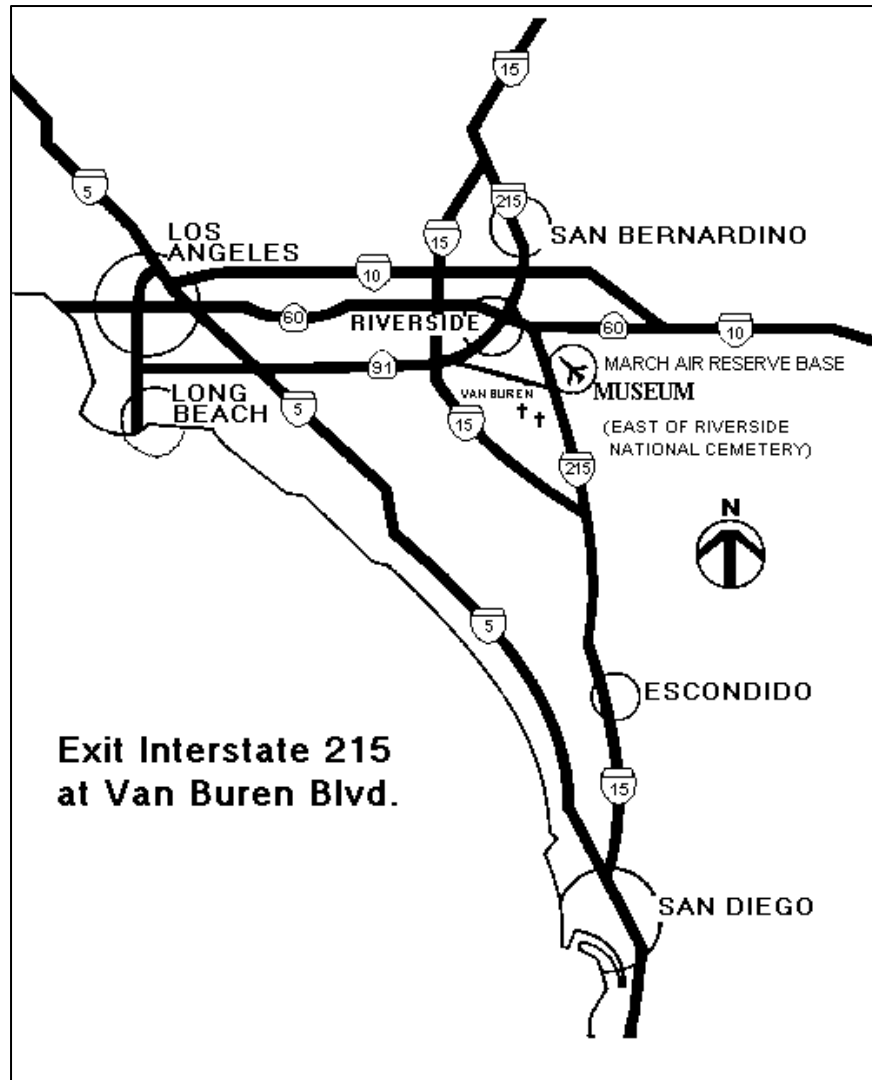
On April 20, 2004 LOGAN completed the installation of a 600kWe PC25C CHP fuel cell installation in Fresno, CA. The system operating configurations allow for both grid parallel and grid independent energy service. The grid independent system is integrated with a Multi Unit Load Sharing (MULS) electronics package and static switch, which initial development was funded by ERDC CERL in 1999. This is the third fuel cell installation that uses the MULS System. The thermal recovery package installed in the project includes a 100-ton chiller that captures 210 degree F thermal energy supplied by the three fuel cells to support cooling loads on the first three floors of the host facility. The fuel cells also provide low-grade waste heat at 140 degrees F that furnishes thermal energy to 98 water source heat pumps located throughout the 12-story building during the winter months.

## 7.0 Host Facility Information

March Air Reserve Base is named for 2nd Lt. Peyton C. March, killed in action on Feb. 18, 1918. It is located 9 mi. southeast of Riverside, California. The base covers about 6,700 acres. Of these 6,700 acres, the Air Force Reserves retain 2,258 acres at the airport. The airfield's 13,300-foot runway is the longest in California

The 4th Air Force, part of Air Force Reserve Command, is headquartered at March ARB. Air Force Reserve Command provides trained units and individuals to accomplish assigned tasks in support of national objectives, and performs peacetime missions that are compatible with training and mobilization readiness requirements. Responsibilities include airlift and refueling duties. It also provides functional mission support units, including aerial port operations, civil engineering, security forces, intelligence, military training, communications, mobility support, combat logistics support, transportation and services.

The 452nd Air Mobility Wing of the 4<sup>th</sup> Air Force represents the only unit-equipped mobility wing in the Reserve. The Wing's KC-135 Strato-tankers and C-141 Star-lifters enable it to effectively perform worldwide missions 365 days a year. It is the only air mobility wing in the Air Force Reserve Command that possesses all of the elements of an air mobility wing. The 163<sup>rd</sup> Air Refueling Wing (ANG) is a tenant unit at March Air Reserve Base, assigned to the Air Mobility Command and the California Air National Guard.



## 8.0 Fuel Cell Installation

The photo in [Figure 1](#) is a picture of Kisling Hall airman's dormitory, Building 400, at March ARB. After conducting two preliminary site visits, LOGAN and the base POC reached a consensus that the dormitory site would provide the best opportunity to display the fuel cell while also making best use of its electrical and thermal load capacities. The fuel cell itself has been placed on a pad just to the left of the chiller seen in [Figure 1](#).

Building 400 was the preferred site for this project because it had the most accommodating energy use profile of any facility at March ARB. It also has two convenient 350-gallon thermal storage tanks in the mechanical room. All utility connections are within 50 to 60 feet of the pad site. The building did not originally have high-speed Ethernet service, but the POC was helpful in assisting LOGAN to acquire the service. The site will simulate a critical load application by wiring outside lighting to the fuel cell's emergency load panel.



Figure 1 – Unoccupied Fuel Cell Pad Site



Figure 2 – Fuel Cell on Pad and Gas Tie-in

As the photos in [Figures 1](#) and [2](#) show, the GenSys5C unit was placed conveniently close to the mechanical room of Building 400. The fuel cell is also in a location that enjoys frequent pedestrian traffic and allows curious bystanders see the system functioning while on display. In the background of [Figure 2](#), the natural gas connection is composed of the yellow piping while the heat recovery loop is completed with the blue and red tubing. Both of these sets of connections enter the building's mechanical room basement just down the sidewalk, as pictured below in [Figure 3](#).

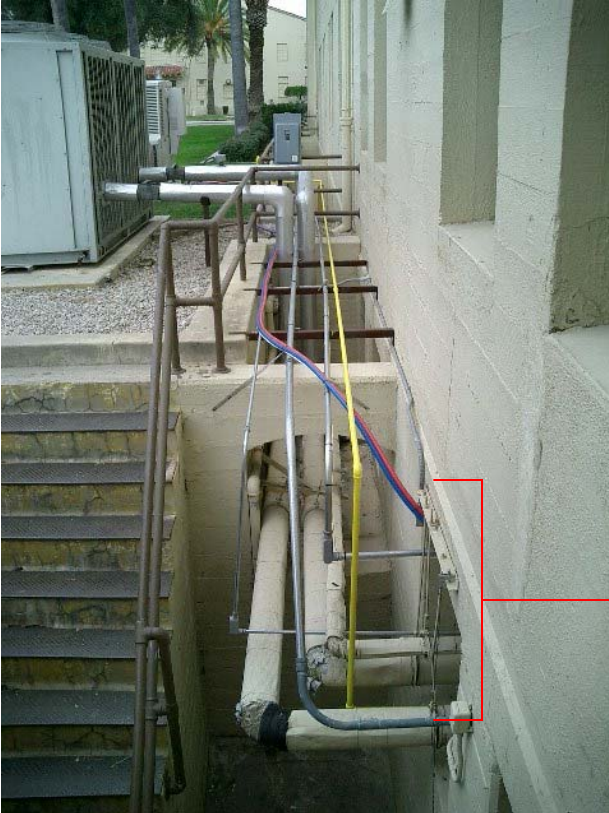


Figure 3 – Conduit, Piping, Thermal Recovery Runs

All of the thermal recovery connections, electrical conduit, and natural gas piping terminate into the mechanical room access panel shown to the left in [Figure 3](#) and below in [Figure 4](#). The access panel used for entering the basement of Building 400 was easily modified by LOGAN technicians to accommodate the connections, and at the same time can be easily restored after the one year demonstration project is complete. Overall, all the modifications made to the site in order to suit the fuel cell were minor at best, and Building 400 will not need any cosmetic restoration as a result of the project.



Figure 4 – Piping Entrances

## 9.0 Electrical System

The Plug Power GenSys5C PEM fuel cell power plant provides both grid parallel and grid independent operating configurations for site power management. This capability is an important milestone in the development of the Gensys5 system on the pathway to product commercialization. The unit has a power output of 110/120 VAC at 60 Hz, and when necessary the voltage can be adjusted to 208 VAC or 220 VAC, depending upon actual site conditions and requirements. The fuel cell has been connected in parallel with the March Air Reserve Base grid feed to the facility via a new 50-amp circuit breaker that LOGAN has installed in the building's existing service panel. In addition, a separate grid-independent emergency panel has been installed to provide service to dedicated loads in the event of a failure of the utility grid feed to the site. This emergency panel can be seen pictured below in [Figure 5](#). Additionally, an emergency disconnect switch and electric meter have been attached to a mounting bracket on one side of the fuel cell. The mounting bracket designed and used by LOGAN technicians on the GenSys model has allowed for easy access to important electrical junctions close to the fuel cell. The mounting bracket and accompanying electrical hardware can be seen below in [Figure 6](#).



Figure 5 – Grid Independent Emergency Panel



Figure 6 – Mounting Bracket and Components

The emergency service panel shown in [Figure 5](#) is located in the basement of Building 400. The mounting bracket is located on the right side of the GenSys5C fuel cell pictured in [Figure 6](#). The green arm and wood paneling that supports the electrical hardware can be seen on the right edge of the photograph. While operating at 2.5 kWe, the unit provides nominally 27-30 amps of power to the effected circuits in the emergency service panel.

## 10.0 Thermal Recovery System

LOGAN installed a Heliodyne heat exchanger to capture fuel cell waste heat and transfer it into the dormitory hot water heater, as seen below in [Figure 7](#) (Note the heat exchanger attached to the wall). The Heliodyne is a looped coil-within-coil design that provides double-wall protection between the heat source and the heat sink. It was designed primarily for the solar heating industry, but has proved to be very adaptable to the fuel cell industry, as LOGAN has used this product effectively at several other PEM demonstration sites. At the March ARB Building 400, the Heliodyne was mounted directly to the wall as seen in [Figure 7](#). It has its own pump that circulates the storage tank in a counter flow against incoming hot water provided by a thermal loop connected to the fuel cell's heat exchanger. While operating at a set point of 2.5 kWh, the fuel cell has a heat rate of approximately 33,000 Btu/h and would provide 7800 Btu/h through the Heliodyne up to the hot water tank.



Figure 7 – Heliodyne and Circulation Pump



Figure 8 – Hot Water Return Tubing

In the two figures above, the Heliodyne system is arranged to transfer fuel cell excess heat to the existing hot-water tank feed line. The red and blue hoses can be seen exiting/entering the Heliodyne at the top of [Figure 7](#) while they terminate into the feed piping in the photograph in [Figure 8](#). Below, in [Figure 9](#), is a picture of the large hot water storage tanks which are being fed by the heat recovery system.



Figure 9 – Hot Water Heaters/Storage Tanks

## 11.0 Data Acquisition System

LOGAN has installed a Connected Energy Corporation web-based SCADA system that provides high-speed access to real-time monitoring of the power plant. The schematic drawing seen below in [Figure 10](#) describes the architecture of the CEC hardware that will support the project. The system provides a comprehensive data acquisition solution and also incorporates remote control, alarming, notification, and reporting functions. The system picks up and displays a number of fuel cell operating parameters on functional display screens, including kWh, cell stack voltage, and water management, as well as external instrumentation inputs including Btus, fuel flow, and thermal loop temperatures. CEC's Operations Control Center, located in Rochester, New York, maintains connectivity by means of a Virtual Private Network that links the fuel cell to the center.

To view the operation of this unit, log on to <https://www.enerview.com/EnerView/login.asp>. Then login as: logan.user and enter the password: guest. Select the box labeled March ARB, or navigate other LOGAN sites using the tool bars or html keys.

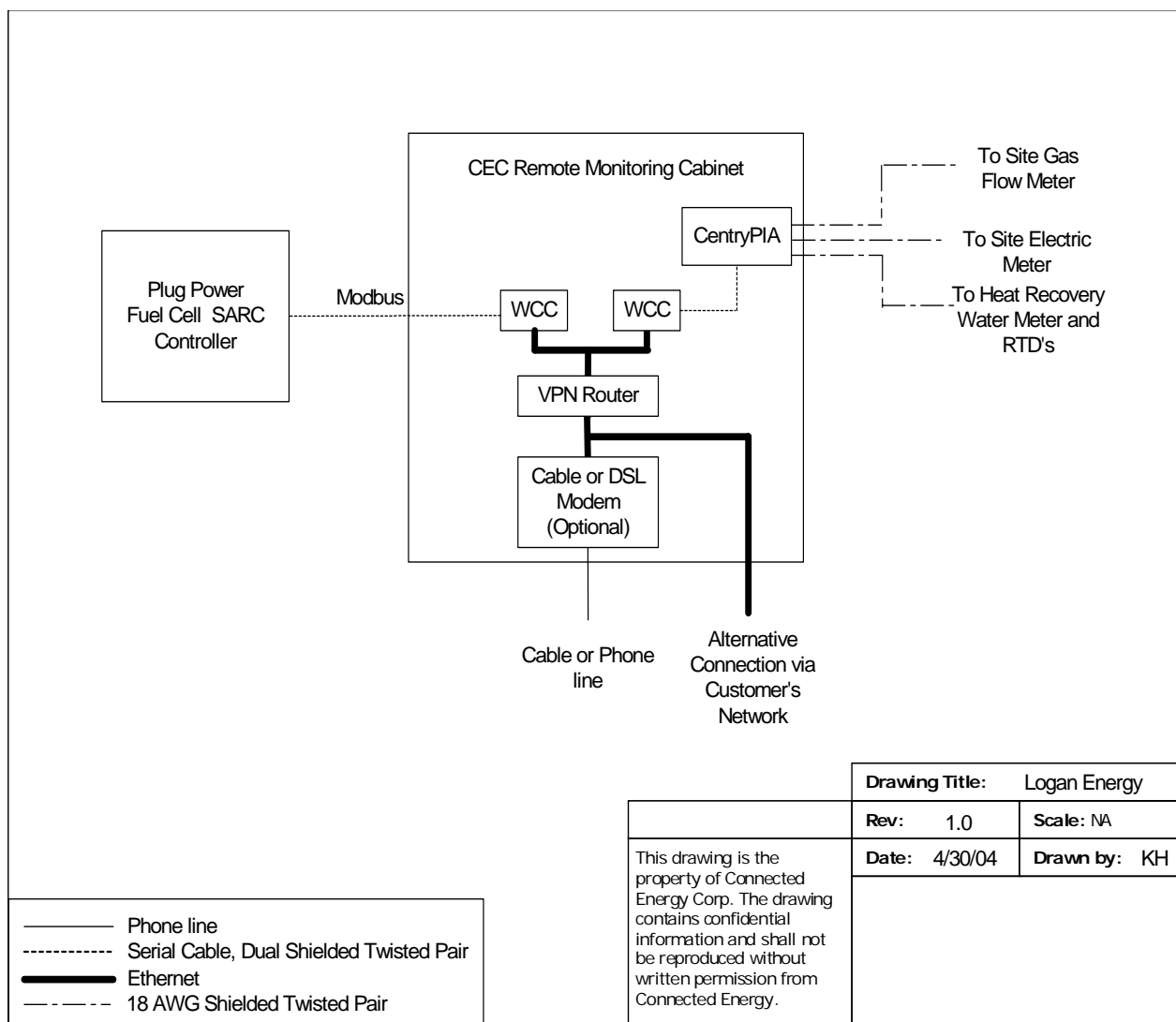


Figure 10 – CEC WEB enabled SCADA Terminal Hardware

LOGAN has procured a high-speed internet connection to the fuel cell router from a local DSL service provider with the help of March ARB POC Jeff Fong. The base has been helpful in providing a local dial tone to a phone jack that is conveniently located in the basement of Building 400 to provide communications with the fuel cell data modem.

## 12.0 Fuel Supply System

LOGAN connected the fuel cell gas piping into the existing natural gas service line adjacent to the fuel cell pad, and installed a flow meter to calculate fuel cell usage as detailed in Paragraph 8.0. A regulator at the fuel cell gas inlet maintains the correct fuel cell operating pressure at 14 inches water column.

## 13.0 Installation Costs

<b>March Air Reserve Base Building 400</b>				
<b>Project Utility Rates</b>			<b>Utility</b>	
1) Water (per 1,000 gallons)		\$12.13		
2) Utility (per KWH)		\$0.0500		
3) Natural Gas ( per MCF)		\$6.63		
<b>First Cost</b>			<b>Estimated</b>	<b>Actual</b>
Plug Power 5 kW GenSys5C			\$ 65,000.00	\$ 65,000.00
Shipping			\$ 1,800.00	\$ 1,060.00
Installation electrical			\$ 1,250.00	\$ 924.00
Installation mechanical & thermal			\$ 3,200.00	\$ 1,700.00
Watt Meter, Instrumentation, Web Package			\$ 3,150.00	\$ 2,950.00
Site Prep, labor materials			\$ 925.00	\$ 1,125.00
Technical Supervision/Start-up			\$ 8,500.00	\$ 13,860.00
Total			<b>\$ 83,825.00</b>	<b>\$ 86,619.00</b>
<b>Assume Five Year Simple Payback</b>			<b>\$ 16,765.00</b>	<b>\$ 17,323.80</b>
<b>Forecast Operating Expenses</b>		Volume	\$/Hr	\$/ Yr
Natural Gas MCF/ hr @ 2.5kW	0.03	\$	0.22	\$ 1,716.47
Water Gallons per Year	14,016			\$ 170.01
Total Annual Operating Cost				\$ 1,886.49
<b>Economic Summary</b>				
Forecast Annual kWH			19710	
Annual Cost of Operating Power Plant		\$	0.096	kWH
Credit Thermal Recovery Rate				kWH
Project Net Operating Cost		\$	0.085	kWH
Displaced Utility cost		\$	0.050	kWH
<b>Energy Savings (Cost)</b>			<b>kWH</b>	
<b>Annual Energy Savings (Cost)</b>				

### **Explanation of Calculations:**

**Actual First Cost Total** is a *sum* of all the listed first cost components.

**Assumed Five Year Simple Payback** is the Estimated First Cost Total *divided by* 5 years.

#### **Forecast Operating Expenses:**

Natural gas usage in a fuel cell system set at 2.5 kW will consume 0.033 MCF per hour. The cost per hour is 0.033 Mcf per hour  $\times$  the cost of natural gas to the site per MCF at **\$6.63**. The cost per year at **\$1716.47** is the cost per hour at **\$0.22**  $\times$  8760 hours per year  $\times$  0.9. The 0.9 is for 90% availability.

Natural gas fuel cell systems set at 2.5 kW will consume 1.6 gallons of water per hour through the DI panel. The total volume of water consumed at 14,016 gallons per year is 1.6 gph  $\times$  8760 hours per year. The cost per year at **\$170.01** is 14,016 gph  $\times$  cost of water to the site at **\$12.13** per 1000 gallons.

The Total Annual Operating Cost, **\$1886.49** is the *sum of* the cost per year for the natural gas and the cost per year for the water consumption.

#### **Economic Summary:**

The Forecast Annual kWh at 19,710 kWh is the product of the 2.5 kW set-point for the fuel cell system  $\times$  8760 hours per year  $\times$  0.9. The 0.9 is for 90% availability.

The Annual Cost of Operating the Power Plant at **\$0.096** per kWh is the Total Annual Operating Cost at **\$1886.49** *divided by* the forecast annual kWh at 19,710 kWh.

The Credit Annual Thermal Recovery at **-\$0.010** is 7800 *divided by* 3414. This is then *multiplied by* 0.9  $\times$  0.1  $\times$  the cost of electricity at **\$0.0500** per kWh  $\times$  (-1). As a credit to the cost summary, the value is expressed as a negative number.

The Project Net Operating Cost is the *sum* of the Annual Cost of Operating the Power Plant *plus* the Credit Annual Thermal Recovery.

The Displaced Utility Cost is the cost of electricity to March ARB per kWh.

**Energy Savings (cost)** equals the Displaced Utility Cost *minus* the Project Net Operating Cost.

**Annual Energy Savings (cost)** equals the Energy Savings  $\times$  the Forecast Annual kWh.

### 14.0 **Acceptance Test**

An 8-hour acceptance test was run on February 24, 2005 by a LOGAN technician following the completion of all the commissioning tasks listed in the Checklist attached below. It was the first successful start-up of the system. Please see [Appendix 2](#) for documentation of the test done by the technician.

## Appendix

### 1) Monthly Performance Data

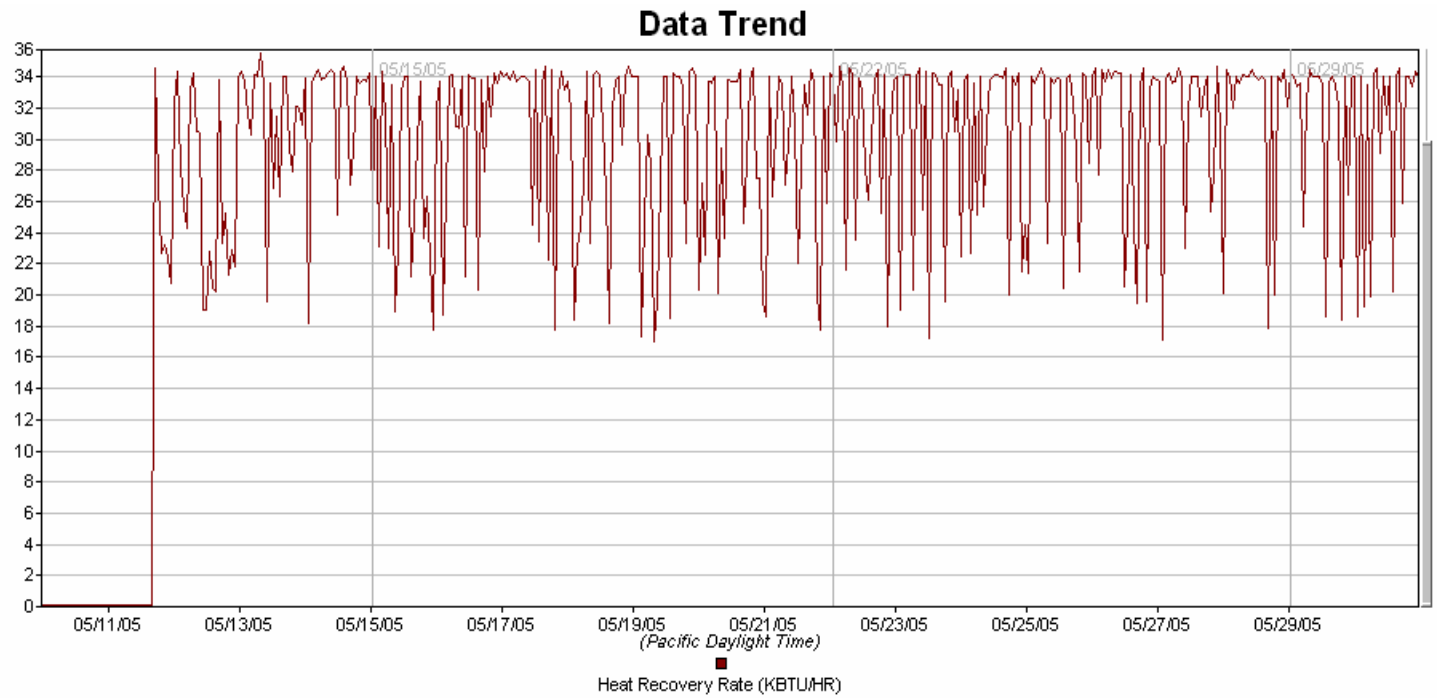


Figure 11 - Heat Recovery Rate at March ARB in kBTu/hr. for May '05

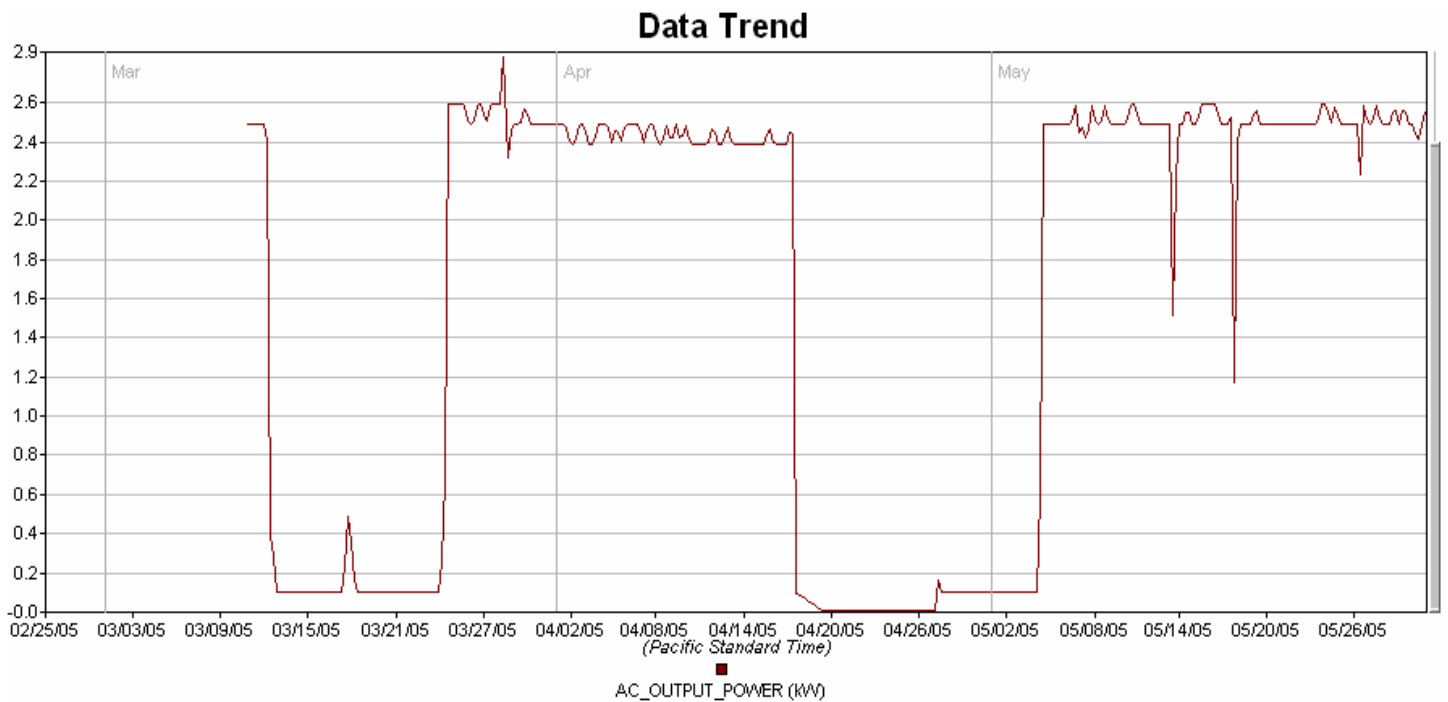


Figure 12 - A/C Output Power at March ARB in kW for May '05

**March Air Reserve Base Dormitory Building #400**  
**Riverside, California**

	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05
Run Time (Hours)	76	298	397	687	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Time in Period (Hours)	76	744	720	744	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Availability (%)	100%	40%	55%	92%	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Energy Produced (kWe-hrs AC)	178.0	769.0	973.0	1725.0	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Output Setting (kW)	2.5	2.5	2.5	2.5	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Average Output (kW)	2.34	2.58	2.45	2.51	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Capacity Factor (%)	46.84%	20.67%	27.03%	46.37%	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Fuel Usage, LHV (kWe-hrs AC)	649.0	2848.0	6747.0	6567.0	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Fuel Usage, LHV (BTUs)	2.21E+06	9.72E+06	2.30E+07	2.24E+07	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Fuel Usage (SCF)	2189	9607	22758	22151	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Electrical Efficiency (%)	27.44%	27.02%	14.43%	26.28%	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Thermal Heat Recovery (BTUs)	0	0	0	0	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Heat Recovery Rate (BTUs/hour)	0	0	0	0	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Thermal Efficiency (%)	0.00%	0.00%	0.00%	0.00%	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Overall Efficiency (%)	27.44%	27.02%	14.43%	26.28%	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Number of Scheduled Outages	0	0	0	0	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Scheduled Outage Hours	0	0	0	0	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Number of Unscheduled Outages	0	3	1	1	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)
Unscheduled Outage Hours	0	446	323	57	(N/a)	(N/a)	(N/a)	(N/a)	(N/a)

## 2) Documentation of Acceptance Test

### Installation/Acceptance Test Report

Site: March Air Reserve Base

#### Installation Check List

TASK	Initials	DATE	TIME (hrs)
Batteries Installed	JW	1/4/05	2
Stack Installed	JW	1/4/05	3
Stack Coolant Installed	JW	1/4/05	1
Air Purged from Stack Coolant	JW	1/4/05	2
Radiator Coolant Installed	JW	1/4/05	3
Air Purged from Radiator Coolant	JW	1/4/05	1
J3 Cable Installed	JW	1/19/05	1
J3 Cable Wiring Tested	JW	1/19/05	0.5
Inverter Power Cable Installed	JW	1/19/05	0.5
Inverter Power Polarity Correct	JW	1/19/05	0.5
RS 232 /Modem Cable Installed	JW	1/19/05	0.5
DI Solenoid Cable Installed with Diode	JW	1/4/05	0.5
Natural Gas Pipe Installed	JW	1/19/05	8
DI Water / Heat Trace Installed	JW	1/4/05	4
Drain Tubing Installed	JW	1/4/05	1

#### Commissioning Check List and Acceptance Test

TASK	Initials	DATE	TIME (hrs)
Controls Powered Up and Communication OK	JW	1/25/05	4
SARC Name Correct	JW	1/25/05	1
Start-Up Initiated	JW	1/25/05	6
Coolant Leak Checked	JW	1/25/05	1
Flammable Gas Leak Checked	JW	1/25/05	1
Data Logging to Central Computer	JW	2/24/05	2
System Run for 8 Hours with No Failures	JW	2/25/05	8

3) Daily Work Logs  
LOGANEnergy Field Technicians  
February '04 – April '05

LOGANEnergy Corp.					
Monthly Site Report					
Period	February-04				
Site	March ARB				
Engineer	Date	PP S/N	Activity	Mileage	Hours
G Collard	2/19/2004	282		140	3
			Met with Martin Mamawal, Base Civil Engineer and Jeff Fong, Electrical engineer. Also in attendance were Jerry Kerns and Jim Crane. We discussed the Plug Fuel Cell I general and the applications we are looking for. We visited three Bks sites. One site is a very good candidate location for a GenSys5.		
G Collard	2/20/2004	282		356	9
			Visited the Ridgehaven site to get more reference photos and to drop off the Proposal Package to Jim Corlett.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	June-04				
Site	March ARB				
Engineer	Date	PP S/N	Activity	Mileage	Hours
G Collard	2/16/2004	282		80	3
			Kick off meeting at March Air Reserve Base, Riverside, CA		

LOGANEnergy Corp.					
Monthly Site Report					
Period	January-05				
Site	March ARB				
Engineer	Date	PP S/N	Activity	Mileage	Hours
G Collard	1/4/2005	282			8
			Mounted R/O unit, Heliodyne and Connected Energy panel. Purchased piping for gas line run. Did layout for electrical conduit run and heat recovery runs. Installed hanger rods for gas line.		
G Collard	1/19/2005	282			

			We had a good day here at March ARB. The electrical is done except for actually hooking the wires to the circuit breakers in the panel. All the wire is run for the connected energy box inputs. The telephone wires are run and I am going to check tomorrow to see if there is a chance of getting our line a couple of days early		
G Collard	1/25/2005	282			
			Michael was on site and changed PS5. He then started the machine with little problems. Machine ran fine, all parameters looked good. He shut it down because we did not have the phone line activated. He was in touch with the telephone personnel and they are going to terminate our phone line first thing this morning. Michael will restart the FC this morning.		
			Sharon received an email telling her that our DSL modem has been shipped.		

LOGANEnergy Corp.					
Monthly Site Report					
Period	February-05				
Site	March ARB				
Engineer	Date	PP S/N	Activity	Mileage	Hours
G Collard	2/5/2005	282			
			1107638949,2/5/2005 4:29:09 PM,Reformer Warmup (32)ALERT, PHONE_LINE1_PASSED, Error Code: (115)(0)		
			1107638997,2/5/2005 4:29:57 PM,Reformer Warmup (32)ALERT, PHONE_LINE2_PASSED, Error Code: (123)(0)		
			1107641956,2/5/2005 5:19:16 PM,Reformer Warmup (32)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1107641956,2/5/2005 5:19:16 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1107642073,2/5/2005 5:21:13 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1107642076,2/5/2005 5:21:16 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107646616,2/5/2005 6:36:56 PM,Reformer Warmup (32)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1107646616,2/5/2005 6:36:56 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		

			1107646733,2/5/2005 6:38:53 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1107646736,2/5/2005 6:38:56 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107655227,2/5/2005 9:00:27 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107655430,2/5/2005 9:03:50 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107657896,2/5/2005 9:44:56 PM,Running (51)SHUTDOWN, HUMIDIFER_TOP_LOW_SD, Error Code: (245)(0)		
			1107662412,2/5/2005 11:00:12 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107663568,2/5/2005 11:19:28 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1107663568,2/5/2005 11:19:28 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1107663777,2/5/2005 11:22:57 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107665757,2/5/2005 11:55:57 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1107665757,2/5/2005 11:55:57 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
G Collard	2/7/2005	282			
			1107793740,2/7/2005 11:29:00 AM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1107793906,2/7/2005 11:31:46 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107799987,2/7/2005 1:13:07 PM,Reformer Warmup (32)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1107799987,2/7/2005 1:13:07 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		

			1107800104,2/7/2005 1:15:04 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1107800107,2/7/2005 1:15:07 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107801450,2/7/2005 1:37:30 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1107801450,2/7/2005 1:37:30 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1107801603,2/7/2005 1:40:03 PM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1107803398,2/7/2005 2:09:58 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107810755,2/7/2005 4:12:35 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107810899,2/7/2005 4:14:59 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107811778,2/7/2005 4:29:38 PM,Running (51)SHUTDOWN, HUMIDIFER_TOP_LOW_SD, Error Code: (245)(0)		
			1107811778,2/7/2005 4:29:38 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1107811897,2/7/2005 4:31:37 PM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1107811900,2/7/2005 4:31:40 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1107821860,2/7/2005 7:17:40 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107821876,2/7/2005 7:17:56 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107822001,2/7/2005 7:20:01 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107822057,2/7/2005 7:20:57 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		

			1107822181,2/7/2005 7:23:01 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107822433,2/7/2005 7:27:13 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107822443,2/7/2005 7:27:23 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107822542,2/7/2005 7:29:02 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107822574,2/7/2005 7:29:34 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107822722,2/7/2005 7:32:02 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107822749,2/7/2005 7:32:29 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107822809,2/7/2005 7:33:29 PM,Running (51)ALERT, HUMIDIFER_TOP_LOW_ALERT, Error Code: (246)(0)		
			1107822902,2/7/2005 7:35:02 PM,Running (51)ALERT, H2_STOICH_HIGH, Error Code: (520)(0)		
			1107823045,2/7/2005 7:37:25 PM,Running (51)SHUTDOWN, HUMIDIFER_TOP_LOW_SD, Error Code: (245)(0)		
			1107823045,2/7/2005 7:37:25 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1107824360,2/7/2005 7:59:20 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
G Collard	2/15/2005	282			
			1108470859,2/15/2005 7:34:19 AM,Running (51)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1108470859,2/15/2005 7:34:19 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1108470976,2/15/2005 7:36:16 AM,Shutdown Complete (105)ALERT, AUTO_RESTART, Error Code: (603)(0)		
			1108470978,2/15/2005 7:36:18 AM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		

			1108515692,2/15/2005 8:01:32 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1108520031,2/15/2005 9:13:51 PM,Running Warmup (50)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1108520031,2/15/2005 9:13:51 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1108524589,2/15/2005 10:29:49 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1108526424,2/15/2005 11:00:24 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1108526424,2/15/2005 11:00:24 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1108526560,2/15/2005 11:02:40 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1108528121,2/15/2005 11:28:41 PM,Unknown (100)ALERT, REMOTE_REQUESTED_SHUTDOWN, Error Code: (600)(0)		
			1108528121,2/15/2005 11:28:41 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
			1108528850,2/15/2005 11:40:50 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
G Collard	2/16/2005	282			
			1108570912,2/16/2005 11:21:52 AM,Running (51)ALERT, HUMIDIFER_TOP_HIGH_ALERT, Error Code: (247)(0)		
			1108571253,2/16/2005 11:27:33 AM,Running (51)SHUTDOWN, HUMIDIFER_TOP_LOW_SD, Error Code: (245)(0)		
			1108571253,2/16/2005 11:27:33 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		

LOGANEnergy Corp.					
Monthly Site Report					
Period	March-05				
Site	March ARB				
Engineer	Date	PP S/N	Activity	Mileage	Hours
G Collard	3/6/2005	282			

			1110108824,3/6/2005 6:33:44 AM,Manual (20)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1110151214,3/6/2005 6:20:14 PM,Manual (20)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1110151214,3/6/2005 6:20:14 PM,Manual (20)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
G Collard	3/7/2005	282			
			1110171601,3/7/2005 12:00:01 AM,Manual (20)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1110171604,3/7/2005 12:00:04 AM,Manual (20)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1110171604,3/7/2005 12:00:04 AM,Manual (20)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
			1110215498,3/7/2005 12:11:38 PM,Manual (20)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1110218107,3/7/2005 12:55:07 PM,Manual (20)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1110218121,3/7/2005 12:55:21 PM,Manual (20)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1110218138,3/7/2005 12:55:38 PM,Manual (20)ALERT, BAT_VOLTAGE_LOW_ALERT, Error Code: (373)(0)		
			1110218203,3/7/2005 12:56:43 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1110238271,3/7/2005 6:31:11 PM,Running (51)ALERT, LOW_CELL_TRIP_ALERT, Error Code: (500)(0)		
			1110239897,3/7/2005 6:58:17 PM,Running (51)SHUTDOWN, LOSS_INVERTER_COMM, Error Code: (523)(0)		
			1110239898,3/7/2005 6:58:18 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
G Collard	3/8/2005	282			
			1110291484,3/8/2005 9:18:04 AM,Reformer Warmup (32)ALERT, PHONE_LINE1_PASSED, Error Code: (115)(0)		

			1110291523,3/8/2005 9:18:43 AM,Reformer Warmup (32)ALERT, PHONE_LINE2_PASSED, Error Code: (123)(0)		
G Collard	3/9/2005	282			
			1110355269,3/9/2005 3:01:09 AM,Running (51)ALERT, I2C_GET_ANALOG_COMM, Error Code: (111)(-32768)		
G Collard	3/10/2005	282			
			1110488323,3/10/2005 3:58:43 PM,Running (51)ALERT, I2C_GET_ANALOG_COMM, Error Code: (111)(-32768)		
G Collard	3/12/2005	282			
			1110636816,3/12/2005 9:13:36 AM,Running (51)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1110636816,3/12/2005 9:13:36 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
G Collard	3/17/2005	282			
			1111095850,3/17/2005 4:44:10 PM,Power Down (200)ALERT, REMOTE_REQUESTED_ESTOP, Error Code: (601)(0)		
			1111099213,3/17/2005 5:40:13 PM,Reformer Purge (31)EVENT, STARTUP_EVENT, Error Code: (1000)(0)		
			1111116726,3/17/2005 10:32:06 PM,Reformer Warmup (32)ALERT, TIMEOUT_HUM_FILL, Error Code: (404)(0)		
G Collard	3/18/2005	282			
			1111123288,3/18/2005 12:21:28 AM,Running Warmup (50)SHUTDOWN, LEVS5_HUMID_LOW_SD, Error Code: (377)(0)		
			1111123288,3/18/2005 12:21:28 AM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		
G Collard	3/18/2005	282			
			It appears that we may have had a batch of bad membranes come through. Michael has very good pressure at March ARB yet he cannot get adequate water. He has changed the membrane with no increase in flow. He checked the pressure on the by bypass valve and has 60 Psi there. This has occurred at a couple of other sites and when a good membrane is installed the R/O unit works fine with no other changes made.		
G Collard	3/24/2005	282			
			R/O unit not putting out enough water.		6
			Replaced the R/O membrane. Installed the Retrofit #076243 FPM DI Polishing		

			Filter Replacement.		
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LOGAN Energy Corp.					
Monthly Site Report					
Period	April-05				
Site	March ARB				
Engineer	Date	PP S/N	Activity	Mileage	Hours
G Collard	4/27/2005	282			
			1114627783,4/27/2005 2:49:43 PM,Reformer Warmup (32)ALERT, PHONE_LINE1_PASSED, Error Code: (115)(0)		
			1114627831,4/27/2005 2:50:31 PM,Reformer Warmup (32)ALERT, PHONE_LINE2_PASSED, Error Code: (123)(0)		
			1114634707,4/27/2005 4:45:07 PM,Running Warmup (50)ESTOP, HW_ESTOP_FG1_L5, Error Code: (531)(0)		
			1114634707,4/27/2005 4:45:07 PM,Running Warmup (50)ESTOP, HW_ESTOP_FG3_L6, Error Code: (532)(0)		
			1114634721,4/27/2005 4:45:21 PM,Running Warmup (50)ALERT, RECOVER_CATHODE_AIR_BLOWER, Error Code: (555)(0)		
			1114634721,4/27/2005 4:45:21 PM,Running Warmup (50)SHUTDOWN, LOSS_FUEL_AIR_BLOWER, Error Code: (545)(0)		
			1114634721,4/27/2005 4:45:21 PM,Unknown (100)SHUTDOWN, LOSS_ATO_BLOWER, Error Code: (546)(0)		
			1114634721,4/27/2005 4:45:21 PM,SD Ref Cool (104)EVENT, SHUTDOWN_EVENT, Error Code: (1001)(0)		